

ON THE OCCURRENCE IN TASMANIA AND  
ON FLINDERS ISLAND OF BRACHYGALAXIAS  
EIGENMANN, 1928 (PISCES: GALAXIIDAE)  
WITH DESCRIPTIONS OF TWO NEW SUBSPECIES

by

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ABSTRACT

The occurrence in Tasmania and on Flinders Island, Furneaux Group, Bass Strait, of the galaxiid genus *Brachygalaxias* Eigenmann, 1928 is reported, and descriptions are given of two new subspecies of the Victorian *B. pusillus* (Mack), 1936, namely, *B. p. tasmaniensis* subsp. nov. from north-eastern Tasmania and *B. p. flindersiensis* subsp. nov. from Flinders Island. The Western Australian member of the genus originally described as a subspecies of the Victorian fish, *B. p. nigrostriatus* (Shipway), 1953, is treated as a distinct species.

INTRODUCTION

In the course of a survey of the genus *Brachygalaxias* Eigenmann, 1928 several new forms have been met with. As early publication of the complete study appears improbable, it has been considered expedient at this stage to report the discovery of the genus in Tasmania and on Flinders Island, Furneaux Group, Bass Strait, and to make available descriptions of material from these sources, regarded as constituting two subspecies of *B. pusillus* (Mack), 1936 from Victoria. An incidental mention of the Tasmanian fish has been made earlier (Scott, 1966: 247).

The status of *Brachygalaxias vis-à-vis Galaxias* Cuvier, (1816) has been discussed by the writer elsewhere (1966). Recent studies of the caudal skeleton by Greenwood, Rosen, Weitzman & Myers (1966) and by McDowall (1969) would appear to add one or more to about a dozen differences between the two genera noted in the paper cited. Though *Brachygalaxias* was not recognized by either of the two Australian authors — Mack (1936), Shipway (1953) — of species now regularly referred to it, and while the question of its validity was expressly left open by another local writer — Mees (1961) — Eigenmann's genus is now almost universally accepted.

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## CONVENTIONS

Measurements are made between parallels; being estimated to the nearest tenth of a millimetre. Absolute dimensions, however, are not recorded in the tables, nor in general cited in discussion (except in the cases of standard length, total length); all direct measurements (*i.e.*, magnitudes other than ratios) being expressed as thousandths of standard length (*TLs*). Standard deviation and derived quantities (*e.g.*, coefficient of variation) are regularly calculated, irrespective of size of sample, with  $n$ , not  $(n-1)$ , degrees of freedom. Procedures follow the recommendations for small samples by Simpson & Roe (1939). In frequency distributions in the text, figures in parentheses denote number of items in the relevant class. It may here be noted, for convenience of immediate reference, that in the estimation of the significance of differences of mean values the least value of  $t$ , for the smallest pooled sample considered, at  $P_{0.05}$  is 2.086, at  $P_{0.01}$  2.845.

Discussion of the provenance of the material examined raises a minor semantic problem (not confined to the present context). To refer to Australia, Tasmania, and Flinders Island as if they represented separate entities of equivalent status is of course to commit a solecism in political geography, Tasmania being one of the States of Australia, and Flinders Island being part of the State of Tasmania. However, to allow due zoogeographical weight to the fact that three discrete land-masses are here involved, and to obviate recourse to the somewhat cumbersome 'mainland of Australia' and the unfamiliar 'mainland of Tasmania', a common local usage is conveniently followed, the three names being treated as being those of three independent and self-contained regions.

THE STATUS OF *Galaxias pusillus nigrostriatus* SHIPWAY, 1953

*Galaxias pusillus nigrostriatus* Shipway, 1953. *W. Aust. Nat.*, 3(8): 173, unnumbered fig. on p. 174. Type locality: small drain feeding into Marbellup Creek, near Albany, Western Australia.

*Brachygalaxias pusillus nigrostriatus* (Shipway). Munro, 1957, *Handbk Aust. Fish.*, 7 : 32, fig. 225 in *Aust. Fisher. Newsl.* (now *Aust. Fisheries*), 16(1).

*Brachygalaxias nigrostriatus* (Shipway). Whitley, 1964, *Proc. Linn. Soc. N.S.W.*, 89(1): 35.

As the present paper proposes new subspecies of *Brachygalaxias pusillus* (Mack), 1936 from Victoria some consideration needs here to be given to the Western Australian galaxiid, *Galaxias pusillus nigrostriatus* Shipway, 1953, treated by its describer as a subspecies of the eastern form. However, in agreement with Whitley (1960, 1964), the writer considers Shipway's fish, now generally relegated to *Brachygalaxias*, to be specifically distinct from Mack's. Unfortunately, the original figure - reproduced in Munro's Handbook and in Whitley (1960) - is not wholly accurate; and the following observations are based on an examination of the holotype, courteously made available for inspection by the Western Australian Museum, Perth.

*Brachygalaxias nigrostriatus* is recognizable at sight by its much larger anal; with 12 rays, against a mode of about 8 and a maximum of 10 in *B. p. pusillus* and in the Tasmanian and Flinders Island subspecies here described. The fin has a base extending through 200 *TLs* units (*cf.* three subspecies means of 104, 110, 124, with an outlying individual entry of 150 : see table 4); slightly exceeding (*cf.* about 1.5-2 in) length of caudal peduncle; subequal to length of head (*cf.* subequal to length from tip of snout to back of eye); subequal to (*cf.* about 1.5 in) ventral-anal interval. The

disproportion in length between dorsal and anal bases is striking, the former being contained twice in the latter in *B. nigrostriatus*, but, on the average only 1.4, 1.5, 1.3 times in the Victorian, Tasmanian, Flinders Island fish, respectively. *B. nigrostriatus* possesses a much longer pectoral, the length of the central rays being equal to the distance from snout tip to preoperculum (*cf.* to ocular border); a noticeably longer caudal, exceeding (*cf.* about 0.6 - 0.8) length of head.

Summarizing the original accounts of *B. pusillus* and *B. nigrostriatus*, Munro (1957) contrasts ventral origin 'slightly nearer to snout than tail base' in the former with 'midway between snout and tail base' in the latter: in our examples of the Victorian fish ventral origin ranges from slightly in front of to slightly behind the middle of the standard length, while in the holotype of the Western Australian fish it is located a little nearer to snout tip than to hypural joint. Again, ventral is stated to extend 1/3 of distance to anal in the former species, 0.6 in the latter species; however, as the data in table 4 show, the Victorian value ranges from 0.3 to 0.6. Little if any diagnostic significance would seem to be attachable to variations noted in the shape of the 'symphyseal cranial pore'.

As figured, *B. pusillus* has 3 longitudinal black lines on the side, *B. nigrostriatus* 2 only. In our material of the former (all subspecies) 3 lines are almost always present: in the holotype of *B. nigrostriatus* there is no trace of a third, dorsally situated stripe; further, the remaining stripes are set closer together than is usual in the other form (apparently being more approximated than in the figure; and with the upper stripe originating somewhat lower down, as in Mack's illustration of his form, about at the level of the middle, instead of the upper border, of the orbit as illustrated).

The Western Australian fish is here recognized as a full species, and is not made the subject of further consideration in this investigation.

*Brachygalaxias pusillus tasmaniensis* subsp. nov.

'An undescribed Tasmanian form' Scott, 1966, *Aust. Zool.*, xiii, (3):247.

*Diagnosis.* - General characters those of the species.

Exhibits statistically significant differences from the Australian *B. pusillus* (Mack), 1936 in respect of the following direct dimensions, expressed as millesimals of standard length: length of pectoral, length of ventral, snout, eye, interorbital, maximum depth, depth of hypural joint (without caudal ridges) - the larger value being found in the new form in all cases except size of eye. Statistics of these dimensions are set out in table 1 (*B. p. pusillus*) and table 2 (*B. p. tasmaniensis*).

Derived magnitudes with means yielding statistically significant differences include: snout in eye, eye in interorbital, pectoral-ventral interval in length of pectoral, ventral-anal interval in length of ventral, interval between anal and dorsal origins - the (numerically) larger value being found in the Tasmanian form in all cases except snout in eye. Specifications of these magnitudes are given in table 4.

Table 5 records *t*- values for differences of means of lengths and ratios listed in the last two paragraphs.

In the material examined, the pectoral of *B. p. pusillus* is consistently shorter than the caudal, the mean difference (47.9 TLs) being more than one-third of pectoral length ( $t$  8.386); in *B. p. tasmaniensis* the pectoral is modally longer than the caudal, the difference of the means just being significant at  $t$  2.095.

Ventral rays 4, rarely 5 (*cf.* 5, rarely 4).

Differs statistically from *B. p. flindersiensis subsp. nov.* in a number of features, enumerated in the diagnosis of that form below.

*Meristic characters.* - D. 6(1), 7(11), 8(2); longest ray (counting here only rays clearly visible) 4th (9), 4th - 5th (3), 5th (2). A. 8(5), 9(6), 10(3); longest (clearly visible) ray 4th (10), 4th-5th (2), 5th (2). P.11 (4), 12 (10). V.4(13), 5(1). C.13(10), 14(4). It is not always feasible to make a definitive count of the myomeres: however, the following counts are probably reliable to within one or two myomeres: 18(4), 19(4), 20(6) + 18(7), 19(7); total 36(2), 37(3), 38(7), 39(2). In 5 (additional) cleared specimens the vertebrae number 18 + 20(2), 18 + 21(1), 19 + 20(1), 19 + 21(1), mean total 38.4.

*Some other characters.* - Lower jaw slightly longer than upper (13), slightly shorter (1). Mouth extending to midway between anterior nostril and eye (1), to just short of eye (3), to eye (8), to 0.05 eye (1), to 0.1 eye (1). Pectoral extending 0.55 - 0.70 ( $\bar{x}$  0.63  $\pm$  0.01) of distance towards ventral; ventral extending 0.43 - 0.67 ( $\bar{x}$  0.57 = 0.02) of distance towards anal. Dorsal originating above 3rd (1), 3rd - 4th (1), 4th (4), 4th - 5th (7), 5th (1) anal ray (clearly visible ray). Anal terminating slightly before or slightly behind (on average, a little in advance of), dorsal termination. Caudal rounded.

*Coloration.* - The original description of *B. pusillus* notes 'colour in spirit pale yellowish with three longitudinal black lines on sides of body' (a longitudinal color pattern appears to be characteristic of the genus). No reference is there made - nor does any occur in the Handbook (Munro, 1954) - to the presence in life of the striking red or orange stripe along the flank reported for *B. bullocki* (Regan), 1908 and *B. nigrostriatus* (Shipway), 1953. Opportunity is here taken to report the life colors of the Tasmanian fish.

Three dark, black or almost black longitudinal lines along whole length of body; uppermost stripe usually the narrowest and least intense, sometimes discontinuous, occasionally obsolescent, originating near upper angle of operculum, and running back close to the dorsal profile, arching upward a little under dorsal base, caudad of which it defines the profile (apart from caudal ridge); middle stripe originating shortly below upper, continuing back subparallel with it, to end at midpoint of caudal base; lowest stripe most conspicuous, continuous, up to twice as wide as either of the others, beginning on head, about at level of bottom of orbit, proceeding, almost straight or very gently convex upward, obliquely backward and downward to region of vent, thereafter straightening out, and extending, either along or barely dorsad of, the ventral border to caudal base: each of the stripes may exhibit, through part or all of its length, a slight local expansion, variable in form and extent, on each myomere. The narrow strip of lateral surface above the superior black stripe, and the contiguous dorsal surface variously yellowish, greyish green, pale olivaceous, frequently with scattered dark chromatophores, at times very numerous; between the upper two stripes yellow or greenish,

usually immaculate. Above the lowest stripe a conspicuous band of bright red, commonly blood red, or orange, either almost even in width throughout or widening posteriorly, sharply delimited above and below, its upper border just meeting the middle black stripe at its hind end, but gradually departing from it cephalad, to lie, at the pectoral, below it by a distance subequal to its own width; the interspace here yellowish, at times slightly dusky (in preserved specimens the red band is often represented either by a continuous or subcontinuous broad white line, or, more commonly, by a regular series of closely set white subrectangular bars, sloping downwards and backwards, one bar to a myomere). Flank below inferior dark stripe silver or silvery white. Ventral surface whitish; normally with two longitudinal series of black spots and/or dashes, extending backward from isthmus more or less parallel to one another, to, or near to, anal base, where they may cease, or beyond which they may continue merely along the fin base, or along it and behind it, or may recommence behind the fin, either retaining their identity in their course along the caudal peduncle, or becoming more or less wholly confluent with the lowest dark stripe of the flank. Ventral surface of head whitish; dorsal surface more or less concolorous with dorsal surface of trunk, often with darker patch or patches on, or on and in advance of occiput; lateral surface yellowish or pale yellowish green; sometimes one or two blood-red spots between orbit and opercular border; pupil black; iris with red, green, gold annulus, more or less surrounded by silver, which may be streaked or mottled with black; lips dusky or dark. Fins other than caudal mostly pale or colorless, the rays normally margined, very narrowly, with blackish; caudal rays orange through all or much of their length, black-bordered throughout. Caudal ridges hyaline or pale yellowish, often partly, occasionally wholly, margined with a very fine dark line.

*Material.* - Described from 14 specimens: 2 from a soak from a dam flowing towards the coast (northward) on *Marengo*, Waterhouse Estate, Dorset, Tasmania, collected by Mr A. M. D. Hewer, March 1964, kept alive by Mr B. C. Mollison till 26 September 1964; 12 from a series from the same locality - associated with pygmy perch, *Nannoperca australis tasmaniae* (Johnston) 1883, and a species of *Saxilaga*, cf. *S. cleaveri* (Scott), 1934 - collected by Mr A. M. D. Hewer, Mr B. C. Mollison and Mr D. Smith, 17 October, 1964. (Frankenberg (1967) has noted the common association, in low-lying swampy country, in Victoria of *Brachygalaxias* with the local pygmy perch, *Nannoperca australis australis* Gunther, 1861.) Standard length (mm) 23.1 - 31.1;  $\bar{x}$  25.33  $\pm$  0.63;  $\sigma$  2.36  $\pm$  0.45;  $V$  9.3  $\pm$  1.8: total length 27.1 - 35.7;  $\bar{x}$  29.37  $\pm$  0.67;  $\sigma$  2.50  $\pm$  0.46;  $V$  8.5  $\pm$  1.6. The largest individual, standard length 31.1 mm, total length 35.7, is selected as holotype (Queen Victoria Museum Reg. No. 1970/5/25a), the rest of the described specimens being designated paratypes. Six additional cleaned and stained specimens have also been examined. Paratypes will be offered to the British Museum (Natural History), London, and the Australian Museum, Sydney.

The *Brachygalaxias pusillus pusillus* material used for comparative purposes comprises 13 specimens (several imperfect), including 4 paratypes, made available for examination by courtesy of the National Museum of Victoria. Several examples collected by Mr R. S. Frankenberg at Tyob, Victoria have also been examined; 2 of these have being cleared and stained.

*Distribution.* - At present known only from north-eastern Tasmania.

*Brachygalaxias pusillus flindersiensis* subsp. nov.

*Diagnosis.* -General characters those of the species.

Exhibits statistically significant differences from the Australian *B. pusillus pusillus* (Mack), 1936 in respect of the following direct dimensions, expressed as millesimals of standard length: length of pectoral, length of ventral, head, snout, eye, interorbital, maximum depth, depth at hypural joint (without caudal ridges) - the larger value being found in all cases in the new form. Statistics of these dimensions are set out in table 1 (*B. p. pusillus*) and table 3 (*B. p. flindersiensis*).

Derived magnitudes with means yielding statistically significant differences include: snout in eye, snout in head, pectoral-ventral interval in length of pectoral, ventral-anal interval in length of ventral - the (numerically) larger value being provided for the first two items by the new subspecies, for the other two items by the typical subspecies. Specifications of these magnitudes are given in table 4.

Table 5 records *t*-values for differences of means of lengths and ratios listed in the last two paragraphs.

In the material examined, the pectoral of *B. p. pusillus* is consistently shorter than the caudal, the mean difference (47.9 *TL*S) being more than one-third of pectoral length (*t* 8.368); in *B. p. flindersiensis* the fins are subequal (pectoral mean 170.4 ± 3.69, caudal mean 167.3 ± 4.44, the difference of the means not being formally significant).

Ventral rays 4 (*cf.* 5, rarely 4).

Exhibits statistically significant differences from the Tasmanian *B. p. tasmaniensis* subsp. nov. in respect of the following direct dimensions, expressed as millesimals of standard length: head, snout, eye, maximum depth, depth at vent, minimum depth of caudal peduncle (including caudal ridges), length to anal termination - the larger value of the first three items being encountered in *B. p. flindersiensis*, of the remainder in *B. p. tasmaniensis*. Statistics of these dimensions are set out in table 2 (*B. p. tasmaniensis*) and table 3 (*B. p. flindersiensis*).

Derived magnitudes with statistically different means include: snout in head, eye in interorbital, interval between anal and dorsal origins, anal base - the (numerically) larger value for all entries being that of *B. p. tasmaniensis*. Specifications of these magnitudes are given in table 4.

Table 5 records *t*-values for differences of means of lengths and ratios in the last two paragraphs.

In the material examined, the pectoral and caudal fins of *B. p. flindersiensis* are subequal in length (see above); in *B. p. tasmaniensis* the pectoral is modally longer than the caudal (*t* 2.095).

Ventral rays 4 (*cf.* 4, rarely 5, in *B. p. tasmaniensis*).

*Meristic characters.* - D.7(8), 8(7); longest ray (counting here only rays clearly visible) 3rd - 4th (1), 4th (14). A.7(1), 8(7), 9(6), 10(1); longest (clearly visible) ray 3rd (1), 4th (9), 4th - 5th (3), 5th (2). P.11 (3). 12 (10), 10/11 (1), 12/13 (1). C.13 (14), 14 (1). Approximate number of myomeres: 19 (2), 20 (2), 21 (11) + 17 (2), 18 (8), 19 (4), 21 (1); total 36 (1), 37 (1), 38 (3), 39 (4), 40 (5), 42 (1). In 8 (additional) cleared specimens the vertebrae number 17 + 20 (1), 17 + 21 (1), 18 + 19 (1), 18 + 20 (2), 19 + 20 (2); 21 + 17 (1); mean total 38.0.

*Some other characters.* - Lower jaw slightly longer than upper (13), jaws equal (1), upper jaw slightly the longer (1). Mouth extending to within 0.15 eye-diameter of eye (1), within 0.1 (6), just short of eye (2), to eye (5), to 0.1 eye (1). Pectoral extending 0.49 - 0.77 ( $\bar{x}$  0.61  $\pm$  0.3) of distance towards ventral; ventral extending 0.47 - 0.69 ( $\bar{x}$  0.55  $\pm$  0.01) of distance towards anal. Dorsal originating above 2nd - 3rd (1), 3rd (9), 3rd - 4th (3), 4th (2) anal ray (clearly visible ray). Anal terminating usually (13) in advance of dorsal termination ( $t$  2.417). Caudal rounded.

*Material.* - Described from 15 specimens from Lackrana, Flinders Island, Furneaux Group, Bass Strait, collected by Messrs R. and C. Rhodes, one example on 4 June, 1969, the remainder part of a series from the same locality, collected 3 July, 1969 (Queen Victoria Museum Reg. No. 1969/5/25). Standard length (mm) 20.8 - 31.3,  $\bar{x}$  23.36  $\pm$  0.71,  $\sigma$  2.76  $\pm$  0.50, V 11.8 + 2.2: total length 24.1 - 36.6,  $\bar{x}$  27.45  $\pm$  0.76,  $\sigma$  2.96  $\pm$  0.54, V 10.7 + 2.0. The largest individual, standard length 31.3, total length 36.6 is selected as holotype (Queen Victoria Museum Reg. No. 1969/5/25 a) the rest of the described specimens being designated paratypes. Eight additional cleared and stained specimens have also been examined. Paratypes will be offered to the British Museum (Natural History), London, and the Australian Museum, Sydney.

#### DISCUSSION

Though the samples here subjected to statistical analysis are small, and some high and some low values of  $t$  are encountered (see Hubbs & Hubbs, 1953), trials of the number of entries falling within the limits  $\bar{x} \pm \sigma$  yield in general figures in very satisfactory agreement with those characterizing the normal distribution - on the assumption of which distribution of the variates the standard parametric procedures are of course formally based. In most biological contexts the pragmatic weight attachable to a run of results individually statistically significant (or even rating just below formal significance) is much greater than that provided by any single such test considered separately; and in the present instance the constellation of good values of  $t$  exhibited in table 5 would seem to point pretty clearly to the existence of genuine taxonomic differences among the three samples from Victoria, Tasmania and Flinders Island here studied. However, these differences are, for the most part, essentially of a statistical nature, affording grounds for the separation of populations, not, unequivocally, of individuals; they are accordingly interpreted as of subspecific, but not specific, import. Perhaps the nearest approach to a definitive criterion for the separation of individuals of, on the one hand, the Victorian form, on the other hand, the Tasmanian and Flinders Island forms is that of number of ventral rays - this is specified in the description of *B. p. pusillus* as 5, and appears seldom to depart from that number, whereas a count of 4 was obtained in 13 of the 14 Tasmanian fish (1 case of 5) and in all the 15 Flinders Island examples examined. Again, relative pectoral and ventral lengths of the two new subspecies noticeably exceed those of the typical subspecies, while scarcely differing between themselves; though ventral values overlap, the minimum pectoral value of the Tasmanian form is identical and that of the Flinders Island form virtually identical (1 TLS unit in excess of), with the maximum value in the Australian (see tables 1, 2, 3). However, in the absence of other notable points of distinction, valid at the level of single specimens, it would appear the appropriate course is the establishment of three subspecies for the samples from the three sources.

While any objective assessment of relative affinity is obviously not feasible, the general impression gained from the handling of the material is that *B. p. tasmaniensis* and *B. p. flindersiensis* are, on the whole, more closely related to one another than either is to *B. p. pusillus*.

The discovery in Tasmania of the genus *Brachygalaxias* affords further evidence of the richness and variety of the galaxiid fauna of this State. To the 6 genera (of twice as many proposed in Galaxiidae) recognized earlier by the writer - namely, (i) *Galaxias* Cuvier, (1816), (ii) *Neochanna* Gunther, 1867, (iii) *Brachygalaxias* Eigenmann, 1928, (iv) *Paragalaxias* Scott, 1935, (v) *Saxilaga* Scott, 1936, (vi) *Agalaxias* Scott, 1936, - there is now to be added (vii) *Nesogalaxias* Whitley, 1935, established for *Galaxias neocaledonicus* Weber & De Beaufort, 1913, which previously imperfectly known form has recently been studied by McDowall (1969), who finds it exhibits skeletal features that would seem clearly to be of generic importance. If this list be accepted, we find the known representation of the family, in terms of genera, in the principal centres of occurrence now stands as follows: South America 2 genera, ? 3 ( (i), (iii), ?(v) ), South Africa 1 ( (vi) ), New Caledonia 1 ( (vii) ), New Zealand 3 ( (i), (ii), (v) ), Australia 2 ( (i), (iii) ), Tasmania 4 ( (i), (iii), (iv), (v) ). However, in a recent paper McDowall (1970) has proposed, largely on osteological grounds, the inclusion of the New Zealand *Galaxias burrowsius* Phillips, 1926, referred by the present writer to *Saxilaga*, in *Neochanna*, hitherto restricted to galaxiids lacking ventral fins. If this suggestion be accepted, and if at the same time the other species that have hitherto been accommodated in *Saxilaga* - the Tasmanian *S. cleaveri* (Scott), 1934, *S. anguilliformis* Scott, 1935, and (?) the South American *S. globiceps* (Eigenmann), 1928 (which forms do not appear to have been made the subject of osteological examination) - are placed in *Neochanna*, the distribution would be: South America 2, ?3 ( (i), (iii), ?(v) ), South Africa 1 ( (vi) ), New Caledonia 1 ( (vii) ), New Zealand 2 ( (i), (ii) ), Australia 2 ( (i), (iii) ), Tasmania 4 ( (i), (ii), (iii), (iv) ). Both summaries leave undistributed *Galaxias dissimilis* Regan, 1906 if the uncertain source of the unique holotype is extra-Tasmanian; in which case the genus is to be credited to the mainland of Australia. The queried entry for South America takes note of *Galaxias globiceps* Eigenmann, 1928, the referring of which to *Saxilaga* has been mooted by Stokell (1959:268).

The record of *Brachygalaxias pusillus flindersiensis* from Flinders Island, Furneaux Group, constitutes a fourth entry on the list of galaxiid fishes from the Bass Strait Islands provided by Frankenberg (1967), who reports the presence of *Galaxias attenuatus* (Jenyns), 1892; *G. truttaceus truttaceus* (Cuvier), (1816), and *G. coxii* Macleay, 1880.



TABLE 1

*Brachygalaxias pusillus pusillus* (Mack), 1936. Specifications of certain dimensions, expressed as thousandths of standard length, of 13 specimens from Cardinia Creek, Victoria

Feature	Range	$\bar{x}$	$\sigma$	<i>V</i>	<i>N</i>
Length to dorsal origin	688 - 750	725.3 ± 5.2	18.1 ± 3.7	2.5 ± 0.5	12
Length to dorsal termination	769 - 815	803.9 ± 4.7	15.6 ± 3.3	1.9 ± 0.4	11
Length to anal origin	658 - 729	692.2 ± 5.5	19.0 ± 3.9	2.7 ± 0.6	12
Length to anal termination	773 - 838	800.8 ± 5.8	19.1 ± 4.1	2.4 ± 0.5	11
Length to ventral origin	481 - 529	504.4 ± 4.3	14.3 ± 3.1	2.8 ± 0.6	10
Length of pectoral	113 - 142	126.2 ± 2.5	8.0 ± 1.8	6.3 ± 1.4	10
Length of ventral	67 - 95	84.2 ± 2.7	8.5 ± 1.9	10.1 ± 2.2	10
Length of caudal	148 - 200	174.1 ± 4.8	15.2 ± 3.4	8.8 ± 2.0	10
Head	201 - 283	219.6 ± 6.9	22.2 ± 4.7	10.1 ± 2.2	11
Snout	37 - 46	41.6 ± 0.7	2.4 ± 0.5	5.7 ± 1.2	12
Eye	69 - 88	78.8 ± 1.5	5.1 ± 1.0	6.5 ± 1.3	12
Interorbital	65 - 83	75.1 ± 1.9	5.6 ± 1.3	7.4 ± 1.8	9
Maximum depth	110 - 190	157.5 ± 7.5	25.0 ± 5.3	15.8 ± 3.5	11
Depth at vent	106 - 134	123.2 ± 2.4	8.0 ± 1.7	6.5 ± 1.4	11
Depth at hypural (without caudal ridges)	39 - 58	50.4 ± 1.4	4.5 ± 1.0	8.9 ± 1.9	11

TABLE 2

*Brachygalaxias pusillus tasmaniensis* subsp. nov. Specifications of certain dimensions, expressed as thousandths of standard length, of 14 specimens from Marengo, Waterhouse Estate, Dorset, Tasmania

Feature	Range	$\bar{x}$	$\sigma$	V
Length to dorsal origin	720 - 768	734.9 ± 2.5	9.2 ± 1.7	1.3 ± 0.2
Length to dorsal termination	792 - 844	820.4 ± 3.6	13.4 ± 2.6	1.7 ± 0.3
Length to anal origin	674 - 717	686.8 ± 2.8	10.6 ± 2.0	1.5 ± 0.3
Length to anal termination	784 - 830	810.4 ± 3.7	13.7 ± 2.6	1.7 ± 0.3
Length to ventral origin	468 - 534	496.6 ± 4.1	15.4 ± 2.9	3.1 ± 0.6
Length of pectoral	142 - 201	173.9 ± 3.8	14.1 ± 2.7	8.1 ± 1.5
Length of ventral	81 - 119	107.2 ± 2.5	9.4 ± 1.8	8.8 ± 1.7
Length of caudal	125 - 193	160.9 ± 4.6	17.2 ± 3.3	10.7 ± 2.0
Head	203 - 255	231.4 ± 3.5	13.1 ± 2.5	5.6 ± 1.1
Snout	38 - 54	45.8 ± 1.1	4.2 ± 0.8	9.1 ± 1.7
Eye	60 - 84	69.7 ± 1.7	6.4 ± 1.2	9.2 ± 1.7
Interorbital	61 - 96	85.0 ± 2.3	8.7 ± 1.7	10.3 ± 2.0
Maximum depth	163 - 219	192.8 ± 3.9	14.7 ± 2.8	7.6 ± 1.5
Depth at vent	150 - 180	164.0 ± 2.4	3.8 ± 1.7	5.3 ± 1.0
Depth at hypural (without caudal ridges)	57 - 82	70.7 ± 1.7	6.3 ± 1.2	8.9 ± 1.7
Minimum depth of caudal peduncle	106 - 145	126.6 ± 2.3	8.6 ± 1.6	6.8 ± 1.3
Length of longest dorsal ray	100 - 125	111.4 ± 2.2	8.1 ± 1.5	7.3 ± 1.4
Length of longest anal ray	104 - 129	117.6 ± 1.9	7.3 ± 1.4	6.2 ± 1.2

TABLE 3

*Brachygalaxias pusillus flindersiensis* subsp. nov. Specifications of certain dimensions, expressed as thousandths of standard length, of 15 specimens from Lackrana, Flinders Island, Bass Strait

Feature	Range	$\bar{x}$	$\sigma$	$v$
Length to dorsal origin	702 - 764	723.5 $\pm$ 4.4	17.1 $\pm$ 3.1	2.4 $\pm$ 0.4
Length to dorsal termination	783 - 837	810.3 $\pm$ 3.9	15.0 $\pm$ 2.7	1.9 $\pm$ 0.3
Length to anal origin	674 - 719	693.0 $\pm$ 3.2	12.6 $\pm$ 2.3	1.8 $\pm$ 0.3
Length to anal termination	778 - 823	797.3 $\pm$ 3.3	12.6 $\pm$ 2.3	1.6 $\pm$ 0.3
Length to ventral origin	483 - 534	504.7 $\pm$ 4.5	17.6 $\pm$ 3.2	3.5 $\pm$ 0.6
Length of pectoral	143 - 195	170.4 $\pm$ 3.7	14.3 $\pm$ 2.6	8.4 $\pm$ 1.5
Length of ventral	92 - 124	102.5 $\pm$ 2.1	8.3 $\pm$ 1.5	8.0 $\pm$ 1.5
Length of caudal	133 - 199	167.3 $\pm$ 4.4	17.2 $\pm$ 3.1	10.3 $\pm$ 1.9
Head	229 - 257	242.4 $\pm$ 2.8	10.9 $\pm$ 2.0	4.5 $\pm$ 0.8
Snout	44 - 68	57.1 $\pm$ 1.9	7.3 $\pm$ 1.3	12.9 $\pm$ 2.4
Eye	70 - 91	83.2 $\pm$ 1.6	6.2 $\pm$ 1.1	7.4 $\pm$ 1.4
Interorbital	74 - 91	81.8 $\pm$ 1.2	4.5 $\pm$ 0.8	5.5 $\pm$ 1.0
Maximum depth	152 - 196	179.7 $\pm$ 3.5	13.6 $\pm$ 2.5	7.5 $\pm$ 1.4
Depth at vent	129 - 179	147.3 $\pm$ 3.1	12.0 $\pm$ 2.2	8.2 $\pm$ 1.5
Depth at hypural (without caudal ridges)	55 - 79	65.0 $\pm$ 2.9	11.2 $\pm$ 2.0	17.1 $\pm$ 3.3
Minimum depth of caudal peduncle	89 - 137	113.7 $\pm$ 3.5	13.5 $\pm$ 2.5	11.9 $\pm$ 2.2
Length of longest dorsal ray	91 - 131	110.0 $\pm$ 2.4	9.4 $\pm$ 1.7	8.6 $\pm$ 1.6
Length of longest anal ray	104 - 136	120.5 $\pm$ 2.4	9.3 $\pm$ 1.7	7.7 $\pm$ 1.4

TABLE 4

*Brachygalaxias pusillus pusillus*, *B. p. tasmaniensis*, *B. p. flindersiensis*. Specifications of certain ratios, and other derived dimensions, the latter expressed as the thousandths of standard length

Feature		Range	$\bar{x}$	$\sigma$	V	N
Snout in head	<i>B. p. p.</i>	4.6 - 6.8	5.30 ± 0.18	0.12 ± 0.06	11.5 ± 2.4	11
	<i>B. p. t.</i>	4.6 - 5.7	5.08 ± 1.12	0.42 ± 0.08	8.3 ± 1.6	14
	<i>B. p. f.</i>	3.4 - 5.1	4.22 ± 0.11	0.43 ± 0.08	10.1 ± 1.9	15
Snout in eye	<i>B. p. p.</i>	1.6 - 2.2	1.89 ± 0.48	0.15 ± 0.03	8.8 ± 1.8	12
	<i>B. p. t.</i>	1.3 - 1.8	1.52 ± 0.41	0.17 ± 0.03	10.1 ± 1.9	14
	<i>B. p. f.</i>	1.0 - 1.9	1.53 ± 0.07	0.27 ± 0.05	17.3 ± 3.3	15
Eye in inter-orbital	<i>B. p. p.</i>	0.9 - 1.0	0.96 ± 0.01	0.02 ± 0.00	1.8 ± 0.4	9
	<i>B. p. t.</i>	0.9 - 1.4	1.23 ± 0.04	0.15 ± 0.03	12.0 ± 2.3	14
	<i>B. p. f.</i>	0.9 - 1.2	0.99 ± 0.02	0.09 ± 0.02	9.2 ± 1.7	15
Pectoral-ventral interval in length of pectoral	<i>B. p. p.</i>	0.3 - 0.5	0.44 ± 0.01	0.03 ± 0.08	7.8 ± 1.8	10
	<i>B. p. t.</i>	0.6 - 0.7	0.63 ± 0.01	0.05 ± 0.01	8.1 ± 1.5	14
	<i>B. p. f.</i>	0.7 - 0.8	0.61 ± 0.03	0.12 ± 0.02	19.0 ± 3.7	15
Ventral-anal interval in length of ventral	<i>B. p. p.</i>	0.3 - 0.6	0.47 ± 0.02	0.07 ± 0.02	1.5 ± 0.3	12
	<i>B. p. t.</i>	0.4 - 0.7	0.57 ± 0.02	0.06 ± 0.01	11.3 ± 2.2	14
	<i>B. p. f.</i>	0.5 - 0.7	0.55 ± 0.01	0.06 ± 0.02	11.5 ± 2.3	15
Interval between anal and dorsal origins	<i>B. p. p.</i>	13 - 57	32.8 ± 3.8	13.0 ± 2.6	39.7 ± 9.3	12
	<i>B. p. t.</i>	38 - 62	48.1 ± 1.8	6.8 ± 1.3	14.1 ± 2.7	14
	<i>B. p. f.</i>	8 - 45	30.3 ± 3.5	13.4 ± 2.5	44.2 ± 9.5	15
Anal base	<i>B. p. p.</i>	78 - 134	110.1 ± 4.4	14.6 ± 3.1	13.3 ± 2.8	11
	<i>B. p. t.</i>	102 - 150	123.5 ± 3.5	12.9 ± 2.4	10.5 ± 1.1	14
	<i>B. p. f.</i>	89 - 121	104.3 ± 2.6	10.0 ± 1.8	9.6 ± 1.8	14

TABLE 5

*Brachygalaxias pusillus pusillus*, *B.p. tasmaniensis*, *B.p. flindersiensis*. Differences of means of 3 samples for some characters, expressed as thousandths of standard length: *t* values. An empty cell indicates a statistically non-significant value of *t* ( $P > 0.05$ ). The initial letter of the third element of the trinomial (*p*, *t*, *f*) identifies the subspecies yielding the (numerically) larger value. The figure in parentheses is the pooled number of specimens

Feature	<i>B.p. pusillus</i> versus <i>B.p. tasmaniensis</i>			<i>B.p. pusillus</i> versus <i>B.p. flindersiensis</i>			<i>B.p. tasmaniensis</i> versus <i>B.p. flindersiensis</i>		
Length of pectoral	9.39	<i>t</i>	(24)	8.55	<i>f</i>	(23)	—		
Length of ventral	5.89	<i>t</i>	(24)	5.16	<i>f</i>	(25)	—		
Head	—			8.31	<i>f</i>	(26)	2.38	<i>f</i>	(29)
Snout	3.31	<i>t</i>	(26)	6.75	<i>f</i>	(25)	3.73	<i>f</i>	(29)
Eye	3.81	<i>p</i>	(26)	2.06	<i>f</i>	(27)	5.60	<i>f</i>	(29)
Interorbital	2.83	<i>t</i>	(23)	3.06	<i>f</i>	(22)	—		
Maximum depth	4.33	<i>t</i>	(25)	2.79	<i>f</i>	(26)	2.57	<i>t</i>	(29)
Depth at vent	10.75	<i>t</i>	(25)	5.33	<i>f</i>	(26)	4.01	<i>t</i>	(29)
Depth at hypural (without caudal ridges)	9.79	<i>t</i>	(25)	3.94	<i>f</i>	(26)	—		
Minimum depth of caudal peduncle	No data			No data			2.91	<i>t</i>	(29)
Length to anal termination	—			—			2.59	<i>t</i>	(29)
Snout in head	—			5.15	<i>p</i>	(26)	5.31	<i>t</i>	(29)
Snout in eye	5.62	<i>p</i>	(26)	3.93	<i>p</i>	(27)	—		
Eye in inter- orbital	5.44	<i>t</i>	(23)	—			5.08	<i>t</i>	(29)
Pectoral-ventral interval in length of pectoral	8.70	<i>t</i>	(24)	4.51	<i>f</i>	(25)	—		
Ventral-anal inter- val in length of ventral	3.59	<i>t</i>	(24)	2.98	<i>f</i>	(25)	—		
Interval between anal and dorsal origins	3.66	<i>t</i>	(26)	—			4.29	<i>t</i>	(29)
Anal base	2.21	<i>t</i>	(25)	—			4.40	<i>t</i>	(29)

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